J. Glob. Innov. Agric. Soc. Sci., 2014, 2(3): 112-115.
ISSN (Online): 2311-3839; ISSN (Print): 2312-5225
DOI: 10.17957/JGIASS/2.3.573
http://www.jgiass.com

PRODUCTION POTENTIAL OF RAPESEED (*BRASSICA NAPUS*L) AS INFLUENCED BY DIFFERENT NITROGEN LEVELS AND DECAPITATION STRESS UNDER THE RAINFED AGRO-CLIMATIC CONDITION OF SWAT-PAKISTAN

Imran[1]*, Asad Ali Khan[1], Irfanullah[2] and Fayaz Ahmad[3]

[1]Department of Agronomy, The University of Agriculture Peshawar – Pakistan
[2]Department of Horticulture, The University of Agriculture Peshawar – Pakistan
3Agriculture Research Institute (N) Mingora Swat, Pakistan
***Correspondence author: imranagrarian@aup.edu.pk**

An experiment entitled "production potential of rapeseed (Brassica napusL) cultivar as influenced by different nitrogen levels and decapitation stress under the rain fed agro-climatic condition of swat-Pakistanwas conducted at Agriculture Research farm Matta(Swat) during Rabi season 2012-13. The field experiment was carried out in randomized complete block design (RCBD) having four replications. The sub plot size was kept 5m x 2.7m having 6 rows with 0.45 m apart. Four levels of nitrogen (0, 33, 66 and 100 kg ha-1) and five levels of decapitation stress (no stress, 5cm, 10, 15 and 20 cm) were used in the experiment using cultivar Oscar. Recommended dose of Phosphorus in the form of SSP were applied at the rate of 60 kg ha-1respectively. From the results it is observed that rapeseed cultivar positively responded for seeds pod-1, thousand seed weight (g), biological yield (kg ha-1), seed yield (kg ha-1) and oil yield (kg ha-1)to N levels and maximumseeds pod-1 (23 seeds), thousand seed weight (3.59 g), biological yield (10310 kg ha-1), seed yield (1169 kg ha-1) and oil yield (600 kg ha-1) was observed in plot treated with 100 kg N ha-1. Whereas minimumseeds pod-1 (15 seeds), thousand seed weight (2.41 g), biological yield (6725 kg ha-1), seed yield (923 kg ha-1) and oil yield (401 kg ha-1) was recorded in control plot. Similarly highest seeds pod-1(22),thousand seed weight (3.3 g), seed yield (1099 kg ha-1) was noted in no decapitation stress inserted plot followed by 20 cm stress inserted plot while promising biological yield (9025 kg ha-1), and oil yield (568 kg ha-1) was recorded in 15 and 20 cm decapitation stress inserted plot. On the basis of the result it is concluded that decapitation stress with 100 kg N ha-1 produced highest seed and oil yield with green chop and recommended for higher seed, oil and biological yield in the rainfedagro- climatic condition of swat valley.
Keywords: Rapeseed (Brassica napusL.), decapitation stress,yield, Oil, seeds pod-1

INTRODUCTION

Rapeseed (Brassica napusL.) belongs to family Cruciferae. There are 160 species concerning with Brassica (Holmes, 1980). Familiar species of rapeseed are Brassica juncea, Brassica carinatea, Brassica nigra, Brassica campestris and Brassica oleraceaL. Rapeseed is a comfortable source of the edible oil. Rapeseed and mustard being traditional and conventional oil seed crop of Pakistan and are grown in all the four provinces of the country over on large area under both rain fed and irrigated situation (Khan et al., 2004). In Pakistan average seed yield production of rapeseed is 812 kg ha-1 (MINFA, 2009), which is very low than other countries of the world. In the current agriculture, nitrogen is a limiting nutrient for growth and consequently to the yield production. So, N fertilization has made an unquestionable contribution to the improvement of yield and quality of crops (Havlin, et al. 2005). The plants obtain the nitrogen, mainly by the application of nitrogen fertilizers, industrially synthesized from the atmospheric N2. However, due to economic as well as environmental reasons, today's challenge lies in maximizing production using the minimum possible amount of N fertilizer (Shehata, et al. 2004). Plants take in N as either nitrate (NO-3) or ammonium (NH+4) and generally grow best when both forms are available (Cramer and Lewis, 1993). Plants convert most of the N that they consume into amino acids, proteins and nucleic acids and typically contain 1– 6% N by weight (Campbell and Reece, 2002). Nitrogen is also an essential ingredient in the chemical structure of chlorophyll, the molecule responsible for converting light into the chemical energy that drives photosynthesis (Havlin, et al. 2005).Primary nutrients deficiency in rapeseed species was recognizable as a serious problem in the crop in New South Wales (NSW), Australia, in 1992, although deficiency symptoms were noticed on several occasions before that time. Since then, research has shown that the problem can be effectively diagnosed in sufficient time to enable recommendations for corrective action which is optimum doze of fertilizer application for the growing crop. Results from this research work were adopted as standard practices by over 90 percent of canola growers in NSW within 2 years.In Pakistan nitrogen (N) is measured as an important nutrient and the status of nitrogen is not common in the soil of the country. Mohammad et al. (1991) concluded that N fertilization enhanced yield and yield components. Same results are also reported by

Rahmatullah et al. (1999) while this was with the agreement of Ahmed et al. (1994) concluded from an experiment that application of different sources of N fertilizers enhanced significantly seed yield of rapeseed. Nitrogen is the most important major elements required for the growth and development of rapeseed and to evaluate the production potential or biological crop potential of rapeseed which deserve particular attention. In view of these the entire procession, present study was conducted and evaluated the influence of N different levels on rapeseed yield and yield contributing parameters under decapitation stress.

MATERIALS AND METHODS

To study the effect of nitrogen and decapitation stress on yield and quality of rapeseed cultivar under rainfed condition an experiment was conducted at Agriculture Research farm Matta (swat) during Rabi season 2012-13. Field experiment was carried out in randomized complete block design (RCBD) with four replications. Four levels of nitrogen (0, 33, 66, and 100 kg ha-1), and five levels of decapitation stress (no stress, 5, 10, 15 and 20 cm) were used in the experiment (cv Oscar).

Sub plot size was used (5mx2.7m) having 6 rows 45 cm apart. Nitrogen was applied in the form of urea. Half dose of N was applied at the time of sowing and the remaining half doses of all treatments wereafter decapitation stress. Phosphorous was applied at the rate of 60 kg ha-1 in the form of SSP at the time of sowing. All the recommended agronomic practices were followed except artificial application of water. Parameters which were studied and data was recorded were,number of seeds pod-1, Thousand seed weight (g), biological yield (kg ha-1), seed yield (kg ha-1)and oil yield (kg ha-1).

Data collected were analyzed statistically according to the procedure relevant to RCB design. Upon significant F-Test, (LSD) test was used for mean comparison to identify the significant components of the treatment means (Jan et al., 2009).

RESULTS AND DISCUSSION

Seeds Pod-1: Data regarding number of seeds pod-1 were recorded in table 1. Analysis of data revealed that nitrogen levels, decapitation stress and interaction between N x Ssignificantly affected number of seeds pod-1. The plots which were treated at the rate of 100 kg N ha-1 produced maximum (23) number of seeds pod-1 while minimum (15) number of seed pod-1 were produced in control plots.This might be due to frequent supply of N to plants which increase dry mater portioning and chlorophyll contents in plant. These findings are closely with conformity of Ahmadi and Bahrani (2009) who's reported the effect of nitrogen levels and concluded that highest N level enhanced plant height, number of branches plant-1, pods plant-1 and seed yield. In case of decapitation stress, maximum (22) seeds pod-1 were produced in control plots, while minimum (16) seed pod-1 were produced in those plots where decapitation stress was inserted at 5 cm.This might be due to high intensity of decapitation stress which reduced number of leaves through which dry matter portioning and chlorophyll contents are decreased. Similar results were reported by Maliket al. (2003) who reported that defoliation up to 14 days before anthesis lead to reduced seed yield. Interaction between N x S show significant and maximum seed yield noted at 100 kg N ha-1 in no stress inserted plots. In case of N x S interaction maximum (28) seeds pod-1were produced in no decapitation stress inserted plots treated with 100 kg N ha-1.

Thousand seed weight (g): Data concerning thousand seed weights present in Table 1divulge that different nitrogen levels and decapitation stress significantly affected 1000 seed weight. The interaction between N x S were also highly significant.Mean values of thousand seed weight indicated that plots which were treated at 100 kg N ha-1 produced maximum (3.59g) seed weight, while minimum (2.41 g) seed weight was noted in control plots. The reason could be that nitrogen level increase assimilates and vegetative growth and as a result days to maturity is exceeded and grain filling duration is extended which collected assimilates toward reproductive units which make heavier, bigger and well-filled grains as compared to no nitrogen application. This agreed with the finding of Kardgar, et al. (2010) studied the effects of different levels of N, Maliket al. (2003), Umar et al. (2012) and Shehuet al. (2010) who reported that seed weight increase with increasing nitrogen level. In case of decapitation stress, control plots produced heavier (3.3 g) seed weight.

Whereas minimum 1000 seed weight was observed in decapitation stress inserted plot.This might be due to less number of leaves which reduce dry matter portioning and chlorophyll contents.These results are out of line with the findings of Khan et al. (2004) who reported that the removal of secondary branches at the initial flowering of rapeseed did not generally affect thousand grain weight and ultimately seed yield.

Biological yield (kg ha-1): Statistical analysis of data regarding biological yield indicated that nitrogen levels, decapitation stress and interaction between N x S significantly affected biological yield of rapeseed. The effect of nitrogen was significant on biological yield of rapeseed.

Plots treatedwith maximum nitrogen level had significantly higher biological yield as compared to control plots. With increase of nitrogen level biological yield increase significantly and therefore the highest level of nitrogen (100 kg ha-1) produced maximum biological yield (10310 kg ha-1) whereas lowest biological yield was recorded in control plot (6725 kg ha-1). This might be due to nitrogen applicationenhance vegetative growth and delay physiological maturity of the crop due to which vegetative period of the crop exceeded and plant attained maximum branches plant-1 and plant height thus enhance biological yield with increase in nitrogen level as compared to control

Table 1: Number of seeds pod-1, thousand seeds weight, biological yield, seed yield and oil yield (kg ha-1) of rapeseed cultivar as influenced by different N levels and decapitation stress

Treatment	Seeds pod^{-1}	thousand seed weight (g)	Biological yield (kg ha^{-1})	Seed yield (kg ha^{-1})	Oil yield (kg ha^{-1})
N levels (kg ha^{-1})					
0	15d	2.41d	6725d	923d	401d
33	18c	3.14c	7420c	970c	436c
66	21b	3.37b	8290b	1043b	519b
100	23a	3.59a	10310a	1169a	600a
LSD (0.05)	0.68	0.05	151	44	29
Decapitation stress (cm)					
0	22a	3.3a	8094c	1099a	481bc
5	16e	3.0d	7325e	958c	434d
10	18d	3.1c	7813d	982b	470c
15	19c	3.1c	9025a	1000b	494b
20	21b	3.2b	8675b	1092a	568a
LSD (0.05)	0.60	0.02	151	23	16
Interaction	*	*	*	*	*

plots. The results are closely with conformity with the finding of Kardgar,et al. (2010) studied the effects of different levels of N and noted that, Nitrogen significantly affected number of siliquesplant-1, numberof seeds silique-1, 1000-seed weight, seed yield, oil yield, biological yield and harvest index. These results also in line with those of Shehuet al. (2010) who reported that significantly increase in biological yield occur with increase the nitrogen levels.

In case of decapitation stress, maximum (9025 kg ha-1) biological yield was recorded in those plots treated with 15 cm decapitation stress and minimum (7325 kg ha-1) biological yield was noted in plots where decapitation stress was inserted at 5 cm.These results were also confirmed by Khan et al. (2004) who stated that when secondary branches removed at the initial flowering of rapeseed they did not generally affect seed yield but only small amount of fodder were obtained. The interaction between N x S both nitrogen and decapitation stress had significant effect on biological yield of rapeseed. But the response of rapeseed to nitrogen level is more as compare to decapitation stress and maximum (12050) biological yield was obtain from plots treated with 100 kg N ha-1and decapitation stress inserted at 15 cm.

Seed yield (kg ha-1): Statistical analysis of data regarding seed yield are presented in Table 1. Analysis of the data exposed that nitrogen levels, decapitation stress and interaction significantly affected seed yield. Mean value showed that seed yield significantly increased with increase in nitrogen levels. Plots supplied with nitrogen had significantly higher seed yield as compared to control plots. With the enhancement of nitrogen level seed yield increased significantly and therefore the highest level of nitrogen (100 kg N ha-1) produced maximum seed yield (1169 kg ha-1) whereas minimum yield was recorded in control plot (923 kg ha-1).

The reason could be that increase in nitrogen levelsenhances branches plant-1, pods plant-1, seed pod-1, and 1000 grain weight and as a result increase the seed yield. The results are supported by the finding of Ahmadi and Bahrani(2009) they reportedthat highest N level had the highest plant height, number of branches plant-1, pods plant-1, seed and oil yields.

In case of decapitation stress, control plots recorded maximum (1099 kg ha-1) seed yield as compared to decapitation stress inserted plots.Similar findings were reported by Kardgar, et al. (2010) who reported that defoliation up to 14 days before anthesis lead to reduced seed yield. Interaction of N x S showed significant effect and maximum seed yield (1365 kg ha-1) was recorded in plot received 100 kg N ha-1 in no decapitation stress inserted plots.

Oil yield (kg ha-1): Data presented in Table 1 indicated that oil yield was significantly affected by nitrogen levels and decapitation stress of rapeseed. Interaction between N xS were also found significant. Mean value shows that plots supplied with nitrogen had significantly higher oil yield as compared to control plots. With increase of nitrogen level oil yield increase significantly and therefore at the highest level of nitrogen (100 kg ha-1) produced maximum oil yield (600 kg ha-1) while lowest yield was recorded in control plots (401 kg ha-1).

These results confirmed by the findings of Kardgar, et al. (2010) studied the effects of different levels of N and noted that, Nitrogen has significantly affected the number of siliquesplant-1, numberof seeds silique-1, 1000-seed weight, seed yield, oil yield, biological yield and harvest index.Shehuet al.

(2010) also reported that increasing rate of nitrogen application up to 120 kg N ha-1 significantly and linearly enhanced oil yield as compared to control plots. In case of decapitation stress, plots in which decapitation stress was inserted at 20 cm shows maximum (568 kg ha-1) oil yield while minimum (364 kg ha-1) oil yield was recorded at decapitation stress inserted at 5 cm. These results are similar to Clarke (1978) studied that Leaf removal at the start of flowering reduced the number of pods per plant, increased seed weight, and reduced seed yield. Leaf removal at the end of flowering did not affect yield or its components.The interaction between nitrogen and decapitation stress had significant effect on oil yield and maximum oil yield (736

kg ha-1) was noted at 100 kg N ha-1with 20 cm decapitation stress.

CONCLUSIONS

From present study it was concluded that rapeseed cultivars significantly increased number of seedspod-1, thousand seed weight, biological yield, seed yield and oil yield with 100 kg N ha-1 as compared to control plots. Decapitation stress levelssignificantly affected seeds pod-1, thousand seed weight and seed yield (kg ha-1) with no decapitation stress inserted plot whereas maximum oil yield (kg ha-1) and biological yield (kg ha-1) was recorded in 15 and 20 cm decapitation stress inserted plot. On the basis of the results it is recommended that cultivar Oscar should be grown with application of Nitrogen at the rate of 100 kg ha-1 with decapitation stressfor higher vegetative parts production for commercial purpose, fodder, seed yield and oil yieldin rainfed regions under the agro-ecological condition of swat valley.

REFERENCES

Ahmad, K. H., I.A. Khalil, and H. Shah. 2004. Nutritional yield and oil quality of canola cultivars grown in NWFP. Sarhad J. Agric. 20: 287- 290.

Ahmad, N., M. T. Saleem, M. Rashid and A. Jalil. 1994. Sulfur status and crop response in Pakistan soils. National fertilizer development center.Pub.No. 7/94.Planning. Develop. Division.islamabad. 1-5.

Ahmadi, M. and M.J. Bahrani. 2009. Yield and Yield Components of Rapeseed as Influenced by Water Stress at Different Growth Stages and Nitrogen Levels. American-Eurasian J. Agric. & Environ. Sci., 5: 755-761.

Campbell, N.A. and J.B. Reece. 2002. Biology. 6th edition.Pearson Education, Inc., publishing as Benjamin Cummings. San Francisco, CA.

Clarke, J.M. 1978. The effects of leaf removal on yield and yield components of Brassica napus . Canadian Journal of Plant Science, 1978, 58: 1103-1105, 10.4141/cjps78-167.

Havlin, J.L., S.L. Tisdale, J.D. Beaton. And W.L. Nelson. 2005. Soil Fertility and Fertilizers: An introduction to nutrient management. 7th edition. Upper Saddle River, NJ: Pearson Prentice Hall. 503.

Jan, M. T, P. Shah, P. A. Hollington, M. J. Khan and Q. Sohail. 2009. Agriculture Research: Design and Analysis, A monograph. Agric. Univ. Pesh. Pak.

Kardgar, v., B. Delkhosh., G. Noormohammadi.and A.H. Shiranirad. 2010. Effects of nitrogen and plant density on yield of field mustard (Brassica campestris). Plant Ecophysiology 2: 157-164.

Khan, A.H., I.A. Khalil, and H. Shah. 2004. Nutritional yield and oil quality of canola cultivars grown in NWFP. Sarhad J. Agric. 20: 287-290.

Malik, M. A., M. F. Saleem, M. A. Cheema and S. Ahmed. 2003. Influence of different nitrogen levels on productivity of sesame(Sesamumindicum L.) under varying planting patterns. Int. J. Agri. Biol. 5: 490-492.

MINFA, 2009.Agriculture statistic of Pakistan, Ministry of food, agriculture and Livestock, Govt. of Pakistan, Islamabad.

Muhammad, S., I. A. Khalil and S. Khan. 1991. Fatty acid composition of rape and mustard oil seed cultivars. Sci. Khyber. 4: 29-36.

Rahmatullah, G. Nabi, M. Salim and M. S. Zia. 1999. Relationship between seed sulfur and phosphorus and seed yield of Brassica napus on two alfisols fertilized with different sulfur sources. Pak. J. Biol. Sci. 2: 462-465.

Shehata, A.S., H. Hamzehzarghani. And M. Edalat. 2010. The impact of nitrogen and organic matter on winter canola seed yield and yield components. AJCS 4: 335-342.

Umar, U. A., M. Mahmud, I. U Abubakar, B. A. Babaji and U. D Idris. 2012. Effect of nitrogen fertilizer level and intra row spacing on growth and yield of sesame (sesamumindicun L.) varietiesTech. Engin. & Applied Sci. 2: 22-27.